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**HISTORIC RAILROADS
ST. FRANCOIS COUNTY MINED AREAS**

St. Francois County, Missouri

January 29, 2007

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TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	Physical Setting	1
1.2	Railroad History	2
1.3	Railroad Construction	3
2.0	SUMMARY OF INVESTIGATION	5
2.1	Historic Railroad Mapping	5
2.2	Vegetation and Soil Development	6
2.3	Cross Sections of Ballast	7
2.4	Ballast Volume Estimation	8
2.5	Ballast Sampling	8
3.0	SUMMARY	10
4.0	REFERENCES	10

LIST OF TABLES

1	Transect Cross-Sectional Areas	7
2	Verified Railroad Segment Volumes	8
3	Cadmium, Lead, and Zinc Concentrations in Ballast Sample Composites	9

LIST OF FIGURES

1	Vicinity Map	2
2	Location of Cross-Sections and Ballast Samples	4

LIST OF APPENDICES

A	Historic Railroad Maps
B	Field Sampling Forms and Photographs
C	Laboratory Data
D	Lead Belt News, 1924 and 1938

Historic Railroads St. Francois County Mined Areas

This report summarizes and reports the assessment of the nature and extent of mine-related materials associated with historic railroad beds in St. Francois County located in southeastern Missouri, pursuant to the Field Sampling Plan for Historical Railroads (NewFields 2006b). This report has been prepared by NewFields on behalf of The Doe Run Company and is being conducted as Additional Work pursuant to Administrative Order on Consent (AOC), U.S. Environmental Protection Agency Docket No. VII-97-F-0002, dated January 29, 1997. This report on historic railroads of St. Francois County, Missouri is submitted as an Addendum to the Focused Remedial Investigation Report dated March 2006 (NewFields 2006a).

1.0 INTRODUCTION

1.1 Physical Setting

The Site is located in southeastern Missouri entirely within St. Francois County, approximately 70 miles south of St. Louis. The topography is hilly with several hundred feet of relief with altitudes ranging from about 700 to 1,000 feet above mean sea level (msl). The climate in St. Francois County is continental with cold winters and hot summers. Annual precipitation is approximately 40 inches with a rainy season in fall and winter. Average annual snowfall is 13.7 inches. Prevailing winds are from the south (Fluor Daniel 1995).

Within the Site boundaries are the incorporated towns of Desloge, Bonne Terre, Park Hills, Leadwood, and Leadington and the unincorporated towns of Frankclay, Wortham, Gumbo, Doe Run and East Bonne Terre. The population of the Site is roughly estimated at 15,000-20,000 (Fluor Daniel 1995; confirmed with 2000 Census).

St. Francois County is located in a historic mining area called the Old Lead Belt. The Old Lead Belt is on the northeastern edge of the Precambrian igneous core of the St. Francois Mountains. This area is one of the world's largest lead mining districts, having produced more than nine million tons of pig lead (MDOH 1997). The first recorded mining in St. Francois County occurred at Mine-a-Gabore between 1742 and 1762. The important discoveries of disseminated lead in the Bonne Terre, Leadwood, and Flat River areas occurred in 1864. The introduction of the diamond drill in 1869 facilitated the discovery of additional reserves and output from the mines increased dramatically in the late 1800s. Mine output from St. Francois County peaked in 1942 when the concentrate equivalent of 197,430 tons of lead was produced. Mining ceased in the Old Lead Belt in 1972 with the closing of St. Joe Lead Company's Federal mine (Fluor Daniel 1995).

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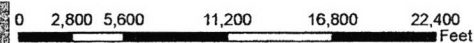
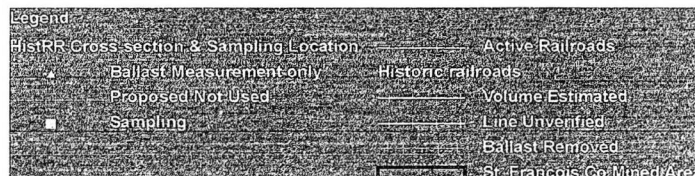


Figure 2
Locations of Cross-sections
and Ballast Samples

Railroads built prior to the advent of dump trucks were constructed by transporting men, equipment and materials to the end of the newly constructed railhead. Ballast was brought in by rail car and dumped at the end of the new rail line. Once the surface of the ballast was brought up to grade, the ties and rails were placed. After a new rail section was set in place and spiked to the ties, more ballast was brought in and the process was repeated.

Modern railroad ballast that meets American Railway Engineering and Mining Association (AREMA) specifications contains between 45 and 80 percent plus 3/4-inch sized rock. An example, Wilson #4 1.5-inch AREMA railroad ballast has been used since the late 1800s. Like most railway ballast, it is composed of a very hard, indurated rock, 100% crushed granite. Other rock types include basalt, metamorphic rock, and hard limestone. In the historic railroad grades of St. Francois County, the chat ballast material is much smaller with a maximum grain size of about 1/2 inch in diameter. A typical chat ballast sample is characterized as a "sand and small gravel". Besides chat, traces of clinker and coal were common. Iron ore was a component of the ballast in the Illinois Southern track, as observed in the sample from HRR-9 south of St. Joe State Park. The rails from this railroad were removed relatively recently, some 20 years ago.

2.0 SUMMARY OF INVESTIGATION

In a July 17, 2006 meeting, EPA requested that The Doe Run Company conduct an investigation to characterize historic railroads in the County, with specific attention given to cadmium, lead, and zinc content in the ballast material and the volume. A field investigation was conducted on November 14-17, 2006 following approval of a Field Sampling Plan (RRFSP) dated October 16, 2006 (NewFields 2006b).

Thirteen (13) locations along the historic railroads were identified in the RRFSP to assess the cross-sectional area and sample remaining railroad ballast (Figure 2). All transect locations were on private land or within St. Joe State Park and access was obtained by The Doe Run Company prior to inspection. No clear evidence of a railroad could be found at the HRR-7 location, so the HRR-14 location was added upon obtaining access. Of the 13 transects, 12 were sampled and cross sections were measured at all 13 locations. Additionally, field volume estimates were made at three other locations (see Figure 2).

2.1 Historic Railroad Mapping

The extent of historic railroads was mapped in AutoGIS and submitted with the Focused Remedial Investigation (RI) in March 2006. Figure 2 depicts approximately 69 miles of abandon railroads. The rail locations depicted in the project GIS and on figures in this report were identified using The Doe Run Company's historic mining maps, Sanborn

2.4 Ballast Volume Estimation

The volume of ballast was estimated by taking the cross-sectional area from Table 1 and multiplying by a measured segment length. ArcGIS calculated the segment length using the base aerial photography. Segment lengths and associated cross-sectional areas are listed in Table 2. Refer to maps provided in Appendix A for specific end points.

Table 2 Verified Railroad Segment Volumes

Segment Location		Length (ft)	Volume per running foot (cy) and reference transect, if used	Segment Volume (cy)
From	To			
Shaft DR #8	Section line	4,159	9.4 HRR-1	39,097
Section line	HRR-11	3,076	12.4 HRR-11	38,141
HRR-11	Old Highway 8	4,051	12.4 HRR-11	50,231
Gumbo	Owl Creek Crossing (OCC)	3,351	33	110,576
West OCC	East OCC	1,171	364 HRR-3	426,395
East OCC	Landfill Road	913	5	4,567
Highway 8	Trailwood St., Desloge	1,863	3.1 HRR-2	5,775
Trailwood St., Desloge	Landfill Rd	1,230	3.1 HRR-2	3,812
Owl Creek	HRR-12	7,399	15.5 HRR-12	114,681
Highway 8	HRR-5	12,852	4.1 HRR-10	52,694
HRR-5	HRR-4	8,228	2.8 HRR-5	23,038
Brightwell Park	National water tower	600	1 HRR-6	600
Shaft Fed #2	St. Francois River	27,927	0.4 HRR-8	11,171
Junction MR & BT RR	St. Joe State Park entrance	5,592	0.4 HRR-8	2,237
St. Francois River	Site boundary, south of town of Doe Run	12,451	2.4	29,883
West: State Hwy B, Illinois Southern RR	East: State Hwy W, Illinois Southern RR	18,244	5.8 HRR-9	105,815
St. Joe State Park tailings edge	Shaft Fed #10	15,702	7.9 HRR-13	124,063
Junction with active RR, south Bonne Terre	Northern Site boundary	21,853	5.5 HRR-14	120,190

Volumes shown are bank cubic yards. For bulk volumes, apply a swell factor of approximately 110% for a clean sand.

2.5 Ballast Sampling

At each transect a composite sample was collected using shovels to characterize the metal content of the ballast. Each composite was composed of four or five aliquots collected to represent the bulk of the ballast material, even if two (or more) distinct materials are identified in the ballast.

For each sampling location a field sheet was constructed diagramming a plan and profile view of the railroad bed and the aliquot sampling locations (see Appendix B). The diagrams show the general configuration of the railroad and other hard features nearby used for locating the sampling area (roads, fences, etc.). Photographs taken during the sampling are also included in Appendix B.

The following information was recorded on the field sampling forms included in Appendix B:

- GPS coordinates and description of sampling point
- Names of sampling team members
- Volume of sample collected
- Sampling methodology
- Plan and profile of transect
- Date and time of sample collection
- Sample identification
- Grain size, slope, erosion, and plant cover
- Nature of organic layer, if present
- Vertical and horizontal ballast measurements
- Photograph numbers and aspect
- Evidence of recent use
- Field portable XRF assay of composite sample.

All samples were analyzed by EPA Method SW-846 6010B for cadmium, lead, and zinc at Evergreen Analytical Laboratory in Wheat Ridge, Colorado. Analytical results are shown in Table 3. Copy of the laboratory report is provided in Appendix C.

**Table 3 Cadmium, Lead, and Zinc Concentrations
in Ballast Sample Composites**

Location	Cadmium	Lead	Zinc	Ratio Zn/Cd
HRR-01	3.3	11000	130	39.4
HRR-02	31	13000	1400	45.2
HRR-03	23	5900	860	37.4
HRR-04	16	14000	880	55.0
HRR-05	120	6400	4500	37.5
HRR-06	13	8200	430	33.1
HRR-08	21	14000	710	33.8
HRR-09*	0.82	250	230	280.5
HRR-10	9.9	1800	330	33.3
HRR-11	1.7	9000	58	34.1
HRR-12	20	17000	680	34.0
HRR-12A*	25	11000	890	35.6
HRR-14	9.6	4200	340	35.4

Notes: * HRR-09 excluded from comparisons in Section 3.0 Summary. HRR-12A is a Duplicate of HRR-12.



One sample blind duplicate was collected at HRR-12. Quality control procedures listed in the St. Francois County QAPP (Dames & Moore 1997) were followed. Duplication of the lead concentrations in HRR-12 and HRR-12A indicates that the ballast lead concentrations are not homogeneous even in well-mixed samples. The so-called "nugget effect" was anticipated as it is almost always observed in duplicate or paired chat sample results.

3.0 SUMMARY

The volume of ballast in the verified historic railroad beds within the investigation area totaled 1,262,966 cubic yards. This is only a rough estimate since 16 volume measurements were made over a rail distance of 30.3 miles. By comparison, there are approximately 39.3 million cubic yards of chat and tailings in the six large piles in the County (RI Table 2-4, NewFields 2006a).

The measured lead concentration in most of the composite samples of chat ballast was at the high end of the range for chat in St. Francois County. Measured cadmium concentrations were quite variable but well within the range reported for St. Francois County. Zinc concentrations were low, comparable only to mill waste from the National, Bonne Terre and Federal piles. The observed zinc to cadmium ratio (Zn/Cd) of 33-55 compares well with the Zn/Cd range of 39-55 reported for mill waste from the six large piles in St. Francois County (RI Table 2-5, NewFields 2006a).

4.0 REFERENCES

- Akers, J. Clyde, 1938. A History of St. Francois County Railroads, published in Lead Belt News, June 10.
- Bratton, K. and Richard Turley, 1979. St. Joe State Park: The Economic, Social, and Physical Impact of Missouri's Second Largest State Park. Southeast Missouri Regional Planning and Economic Development Commission, March 1979.
- Buckley, E.R. 1908, Geology of the disseminated lead deposits of St. Francois and Washington Counties: Rolla, Missouri Division of Geology and Land Survey, v. IX, parts 1 and 2, 259 pages (includes plate XLVIII, Geologic Maps of the Flat River – Leadwood Areas).
- Dames & Moore, 1997. Field Sampling Plan for Focused Remedial Investigation/Feasibility Study, St. Francois County, Missouri. November 19.
- Fluor Daniel, 1995. Initial Remedial Investigations for the Big River Mine Tailings Site, St. Francois County, Missouri.

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MDOH, 1997. Big River Mine Tailings Superfund Site, Lead Exposure Study: Report to the Agency for Toxic Substances and Disease Registry. Draft Final Report, April 21.

NewFields, 2006a. Focused Remedial Investigation for Mined Areas in St. Francois County, Missouri. March 3.

NewFields, 2006b. Field Sampling For Historical Railroads, St. Francois County Mined Areas, Missouri. October 16.

